

## 6.3 Acid-base titration

**Titration** is a technique used to find the concentration of a solution. A fixed volume of one solution is added to a conical flask. Another solution is added in small quantities from a burette. The concentration of one of these solutions is known, whereas the concentration of the other is unknown. The concentration of the unknown solution can be determined from the **end-point** of the titration.

### Aim

To titrate sodium hydroxide solution with dilute hydrochloric acid.

### Apparatus and materials

Measuring cylinder, 25 cm<sup>3</sup>

Burette, 50 cm<sup>3</sup>

Conical flask, 100 cm<sup>3</sup>

Sodium hydroxide solution, 0.1 mol dm<sup>-3</sup>

Hydrochloric acid, 0.1 mol dm<sup>-3</sup>

Universal Indicator solution

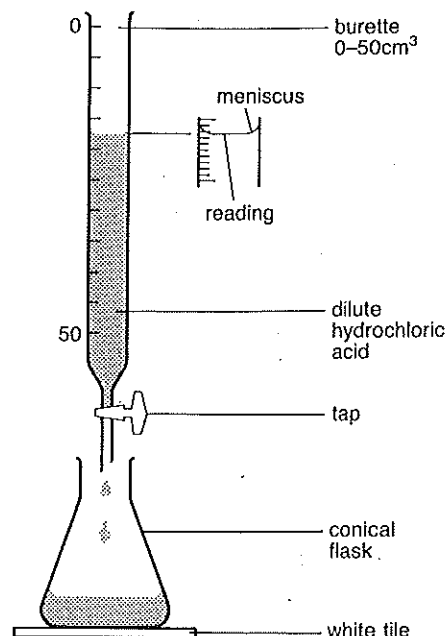
pH chart

Dropping pipette

White tile or white paper

### Procedure

- 1 Wash out the burette with distilled water and then wash out with a solution of the acid.
- 2 Allow some of the acid solution to drain through the burette so that the part of the burette below the tap is filled. Fill the burette up to the zero mark or another whole number near to zero. Clamp the burette in a stand.
- 3 Using the measuring cylinder place 25 cm<sup>3</sup> of the sodium hydroxide solution in the flask.
- 4 Add 10 drops of Universal Indicator solution to the alkali.
- 5 Run acid into the conical flask, 2 cm<sup>3</sup> at a time until 20 cm<sup>3</sup> have been added. Note the colour produced after each addition and compare it with the pH chart. Record the pH at each stage.
- 6 Add the acid, a few drops at a time, until there is a colour change. At each colour change record the total volume of acid added as well as the pH.
- 7 Continue to add acid slowly until the colour change is not as fast. Once this has happened return to adding 2 cm<sup>3</sup> of acid until the colour no longer changes.



### Results

Burette reading at start of experiment ..... cm<sup>3</sup>

reading on burette/cm <sup>3</sup>	volume of acid added/cm <sup>3</sup>	colour	pH

The end point occurred when ..... cm<sup>3</sup> of acid was added.

Plot the graph of pH (vertical axis) against volume of acid added (horizontal axis).

### Extra work

- Carry out the experiment more accurately using a 25 cm<sup>3</sup> pipette.
- Carry out the titration using the indicator phenolphthalein to determine the end point.
- Adapt the experiment to prepare sodium chloride. More concentrated solutions of acid and alkali should be used.

### Questions

- 1 a) Why is a conical flask used, not a beaker?  
b) Write an equation for the reaction above.  
c) What is meant by the 'end point'?  
d) How many different colours did you see in the conical flask? Name them.  
e) Describe how the reading is taken from the meniscus in the burette?